REMARKS

Attached hereto is Exhibit A, a Preliminary Amendment received by the USPTO on April 23, 2003 per the copy of the postcard.

Applicant has proceeded addressing the Examiner with the presumption that new claims 18-24 shall be entered by the Examiner. Applicant notes that a Petition to Make Special per 37 C.F.R. 1.102 (c) (age over 65) was never addressed by the USPTO, and it took 34 months for a first Office Action.

Applicant has corrected the figures by adding the "G" and arrows, without adding new matter.

Applicant has corrected the typographical error in the specification, page 6, lines 2-3, replacing "31" with "39." Applicant has corrected the typo in claim 13, without any narrowing of the affected claims.

Regarding the Examiner's §103(a) rejections, Applicant has attached as Exhibit B, a marketing brochure which explains the importance of "low impedance" in the pending claims. Furthermore, the problems with prior art shunts in general apply to the Nelson invention, namely wax buildups create high impedance connections, all springs fatigue creating high impedance connections, and the roof floats causing potential separations from Nelson's coils and the tank side, resulting in a high impedance connection.

Examiner cites to Nelson's col. 1, lines 60-68 and col. 2, lines 1-20 for the support that says Nelson teaches a "low impedance" connection from roof to tank side. However, the words "low impedance" do not exist anywhere in Nelson. Also Nelson does not discuss any utility for his device in the case of a nearby lightning strike.

Applicant argues that Nelson does not teach nor suggest the claimed element of "low impedance" as defined in Applicant's specification, see page 2, lines 26-28. Applicant describes the impedance of the prior art of a wire as about 150-250 ohms. Applicant suggests that Nelson's impedance, which he leaves not specified, as falling in the range of a prior art wire, about 150-250 ohms, because Nelson's invention is just a wire wound into a spring(s).

Distinguishing all of Applicant's independent claims is the element "low impedance" which means substantially lower than the prior art 150-250 ohms. Applicant's detailed description of the components allow an electrical engineer to calculate the bare braided copper cable (480/30 flat) impedance, wherein even for the entire height of a large oil storage tank the "low impedance" would be proportional to the height of the tank and inversely proportional to the width of the wire braid.

Applicant argues that no reference cited by Examiner teaches a "low impedance" connection from a floating roof to a tank side. Therefore, all of Applicant's claims are allowable.

As to the Powell reference, a reel 18 does wind up grounding leads 19a, 19b. However, no lightning protection utility is suggested by Powell. Powell only addresses a static charge equalization during the static buildup of flowing fluids into the tank. No "low impedance" suggestions for handling 1-20 microsecond responses exist. Absolutely no suggestions exist to attach Powell's reel to the top of the tank, and then replace wires 19a, 19b with a type of lead like a braided copper wire with low impedance from his reel to a floating roof which is not even shown.

Furthermore, Nelson's spring 5 cannot possibly be "wound up on a reel" as Examiner suggests. Nelson's background, col. 1, lines 1-17 describe an under-the-roof cable which attaches to the bottom of the tank, but has problems including kinking. Examiner might consider citing an obviousness rejection using Nelson's prior art. However, no braided wire type "low impedance" connection is described in the prior art. Also the connection of the known cable to the top of the tank isn't described, nor is a reel for this known cable described.

Applicant argues that he has taken an inventive giant step by using a braided cable type connector along with a take-up reel to minimize the length of the braided cable and prevent kinking, along with putting the reel on top (not under the fluid) of the tank.

Applicant is selling the present invention by the hundreds to expert buyers, who have not had a solution to this (lightning resistant) roof ground problem for over twenty years.

LAW OF OBVIOUSNESS

It is well known that most inventions are composed of elements that *per se* are old and well known. That however, does not make an invention "obvious" under 35 U.S.C. 103. The Examiner's attention is respectfully drawn to, for example, *ACS Hospital Systems, Inc. v. Montefiore Hospital et al.*, 732 F.2d 1572, 1577, 221 USPQ 929 (Fed. Cir. 1984), wherein the Court held that "[o]bviousness cannot be established by combining the teachings of the prior art to produce the claimed combination, absent some teaching or suggestion supporting the combination. Under section 103, teachings of references can be combined *only* if there is some suggestion or incentive to do so."

Also, as stated in *W.L. Gore & Associates, Inc. v. Garlock, Inc.* 721 F.2d 1540, 1553, 220 USPQ 303 (Fed. Cir. 1983):

> To imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.

Finally, even if all the constituents of an invention may be old, if the result would not have been obvious at the time the invention was made to a person having ordinary skill in the art, then the result may be patentable. *Reiner v. I. Leon Co.*, 285 F.2d 501, 503-504, 128 USPQ 25, (2d Cir. 1960).

In view of the above, Applicant respectfully requests a Notice of Allowance.

Respectfully submitted,

Date: 2-17-04

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Exh. B, T A

POSTCARD ACKNOWLEDGEMENT OF RECEIPT OF PAPERS BY PATENT AND TRADEMARK OFFICE

The following papers were received in the U.S. Patent and Trademark Office:

Applicant: Roy B. Carpenter, Jr.
Title of Invention: Grounding System for Floating Roofs...
Case No. RM26ii Serial No. 09/769,670 Filed 1/25/2001

- ☐ Specification - No. of Pages ____
- ☐ Claims - No. of Claims ____
- ☐ Drawings - No. of Sheets ____
- ☐ Declaration and Power of Attorney
- ☐ Assignment
- ☒ PTO Transmittal Letter
- ☒ Amendment (preliminary)
- ☐ Petition To ____
- ☐ Request for Extension of Time
- ☐ Issue Fee
- ☐ Information Disclosure
- ☐ Fee: ____ Enclosed

OIPE JC67 APR 23 2003 PATENT & TRADEMARK OFFICE

Attorney: RM

Date Mailed: 4/18/03

RECEIVED

FEB 24 2004

AMENDMENT TRANSMITTAL LETTER (Small Entity) Applicant(s):			Docket No. RM26ii
Serial No. 09/769,670	Filing Date 1/25/01	Examiner Steven Post	Group Art Unit 3653

Invention:

Grounding System for Floating Roofs in Flammable Storage Tanks

TO THE ASSISTANT COMMISSIONER FOR PATENTS:

Transmitted herewith is an amendment in the above-identified application.

- ☐ Small Entity status of this application has been established under 37 CFR 1.27 by a verified statement previously submitted.
- ☐ A verified statement to establish Small Entity status under 37 FR 1.27 is enclosed.

The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST # PREV. PAID FOR		NUMBER EXTRA CLAIMS PRESENT	RATE		ADDITIONAL FEE
TOTAL CLAIMS	24	-	20	=	4	x	$9.00	$36.00
INDEP. CLAIMS	4	-	3	=	1	x	$42.00	$42.00
Multiple Dependent Claims (check if applicable) ☐								$0.00
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT								$78.00

- ☐ No additional fee is required for amendment.
- ☐ Please charge Deposit Account No. in the amount of
  A duplicate copy of this sheet is enclosed.
- ☐ A check in the amount of to cover the filing fee is enclosed.
- ☒ The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account No. **50-0617**
  A duplicate copy of this sheet is enclosed.
  - ☒ Any additional filing fees required under 37 C.F.R. 1.16.
  - ☒ Any patent application processing fees under 37 CFR 1.17.

Rick Martin — *Signature*

Dated: 4-18-03

Rick Martin Reg. No. 32,267
Patent Law Offices of Rick Martin, P.C.
416 Coffman Street
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303-651-2177

I certify that this document and fee is being deposited on 4/18/2003 with the U.S. Postal Service as first class mail under 37 C.F.R. 1.8 and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Shireen Marshall — *Signature of Person Mailing Correspondence*

Shireen Marshall
Typed or Printed Name of Person Mailing Correspondence

cc:

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Roy B. Carpenter, Jr. et al.		
Serial No.:	09/769,670	Group Art Unit:	3653
Filed:	January 25, 2001	Examiner:	Steven Post
For:	Grounding System for Floating Roofs in Flammable Storage Tanks	Attorney Docket:	RM26ii

Assistant Commissioner for Patents
Washington, DC 20231

PRELIMINARY AMENDMENT

Dear Sir:

Please amend the above referenced application as follows:

In the Claims:

For the convenience of the Examiner, all claims, including those not changed by the present amendment, have been included.

1. (original) In a fluid/liquid storage tank with a sidewall and a floating roof floating atop the fluid/liquid, an improved grounding system comprising:

a reel connected to the sidewall; and

said reel having a low impedance conductor connected to the floating roof.

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington DC 20231 on: 4/18/2003.

Shireen Marshall

Shireen Marshall

2. (original) The improvement of claim 1, wherein the reel further comprises a take up spool which keeps any slack out of the conductor and maintains a shortest fractional length.

3. (original) The improvement of claim 2, wherein the take up spool further comprises a spring.

4. (original) The improvement of claim 1, wherein the wire further comprises a bare braided copper cable.

5. (original) The improvement of claim 1, wherein the reel further comprises a base having bolts secured to the tank wall.

6. (original) The improvement of claim 4, wherein the bare braided copper cable further comprises a lug having a bolt secured to the floating roof.

7. (original) The improvement of claim 6, wherein the impedance of the lug and bolt, plus the braided copper cable plus the reel is about one ohm or less.

8. (original) A grounding system for a storage tank having a floating roof, said grounding system comprising:

a wire having an end connected to the floating roof;

said wire having a second end wound around a spool in a reel;

said reel having a grounded connection to a wall segment of the tank; and

said wire having a low impedance.

9. (original) The grounding system of claim 8, wherein the wire further comprises a flat braided copper conductor.

10. (original) The grounding system of claim 9, wherein the spool further comprises a take up mechanism to minimize slack in the conductor.

11. (original) The grounding system of claim 10, wherein the total impedance of the system is about five ohms or less.

12. (original) A grounding system for a tank with a floating roof, said grounding system comprising:

means for taking slack out of a cable connected from a floating roof to an upper segment of a tank wall, and thereby maintaining a minimum length; and

said cable having a low impedance.

13. (original) The grounding system of claim 11, wherein the means of taking slack out further comprises a reel having a take up spool.

14. (original) The grounding system of claim 13, wherein the take up spool further comprises a spring functioning to constantly pull up on the cable.

15. (original) The grounding system of claim 13, wherein the cable further comprises a braided conductor.

16. (original) The grounding system of claim 15, wherein the system has a total impedance of about five ohms or less.

17. (original) The grounding system of claim 15, wherein the braided conductor has a bolt connection to the floating roof, and the reel has a base with a bolt connection to the tank wall.

18. (new) In a fluid/liquid storage tank with a sidewall and a floating roof floating atop the fluid/liquid, an improved grounding system comprising:

a reel connectable to the sidewall; and

said reel having a low impedance conductor connectable to the floating roof.

19. (new) The improvement of claim 18, wherein the reel further comprises a take up spool which keeps any slack out of the conductor and maintains a shortest fractional length.

20. (new) The improvement of claim 19, wherein the take up spool further comprises a spring.

21. (new) The improvement of claim 18, wherein the wire further comprises a bare braided copper cable.

22. (new) The improvement of claim 18, wherein the reel further comprises a base having bolts secured to the tank wall.

23. (new) The improvement of claim 21, wherein the bare braided copper cable further comprises a lug having a bolt secured to the floating roof.

24. (new) The improvement of claim 23, wherein the impedance of the lug and bolt, plus the braided copper cable plus the reel is about one ohm or less.

In view of the above, Applicant respectfully requests that this application be passed to allowance.

Respectfully submitted,

Date: 4-8-03

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MAKING A CONNECTION BETWEEN THE TANK WALL AND THE FLOATING ROOF

Background

The roofs of many large crude storage tanks are open in the sense that there is not a permanently attached roof. It floats on top of the product. To prevent vapors from escaping from around the edge of the roof, it is common to provide some sort of seal. These seals are made of a non-conductive material, usually neoprene. This material isolates the roof from the tank wall electrically, and from any connection to earth. To overcome this problem, the industry usually installs a device called a "shunt." These shunts are attached to the roof in such a manner that they are to be in constant contact with the tank wall regardless of the position of the floating roof. To make contact, these shunts are usually made with metal fingers, which are designed to make contact with the tank wall directly. The contact resistance depends on the characteristic of the material used. The contact pressure and the state of the tank wall. History has proven that these shunts require constant maintenance for several reasons. These include:

1. Since the roof does float, it can easily drift slightly off center and disconnect from the opposite side.

2. Wax and other heavy crude components tend to deposit between the tank wall and the shunt fingers forming an insulator between them.

3. The gap is so small that an arc can easily jump that space, and ignite a fire when a charge is on the product. This is called a "rim fire".

During an electrical storm, the electrostatic field will induce a charge on both the tank and the contained product. If that tank is protected with a Dissipation Array® System (DAS), that DAS will discharge both the tank and the product for most situations. However, if the tank has a large diameter, the storm cell contains an unusually large charge, the product near the center will not be completely discharged. Then, if the shunts are not in perfect contact with the tank wall, a "Bound Charge" will build up and create an arc between them when that storm cell is discharged by a nearby strike. Refer to the American Petroleum Institute (API) Recommended Practices RP2003 for details on the Bound Charge/Secondary Arc.

The Prevention Requirement

Some companies have tried to use long wires that extend from the top of the tank wall down to the center of the floating roof. Worse yet, they extend the wire to one edge of that roof. However, the impedance of that wire was far too high to react within the time available to discharge a bound charge (about one microsecond). The average inductive impedance of these connections can exceed 500 ohms at lightning frequencies.

Exhibit

B

Making a positive connection between the floating roof and the tank wall, all the time and with a path impedance low enough to eliminate this risk and the risk other phenomena that can create any other body of bound charge on the product. For example, high flow rates during the tank filling process can create a significant charge on the product.

The subsequent photographs illustrate some of the potential problems encountered in trying to make that connection.

Figure 1 and 2 illustrates a typical approach to making a connection, using about two to four-inch wide stainless steel shunts. At close inspection, some do not touch the wall; others appear to make a connection. But when measurements of the contact resistance are made, it yields a high resistance or no connection at all. Rust was found to function as an insulator.

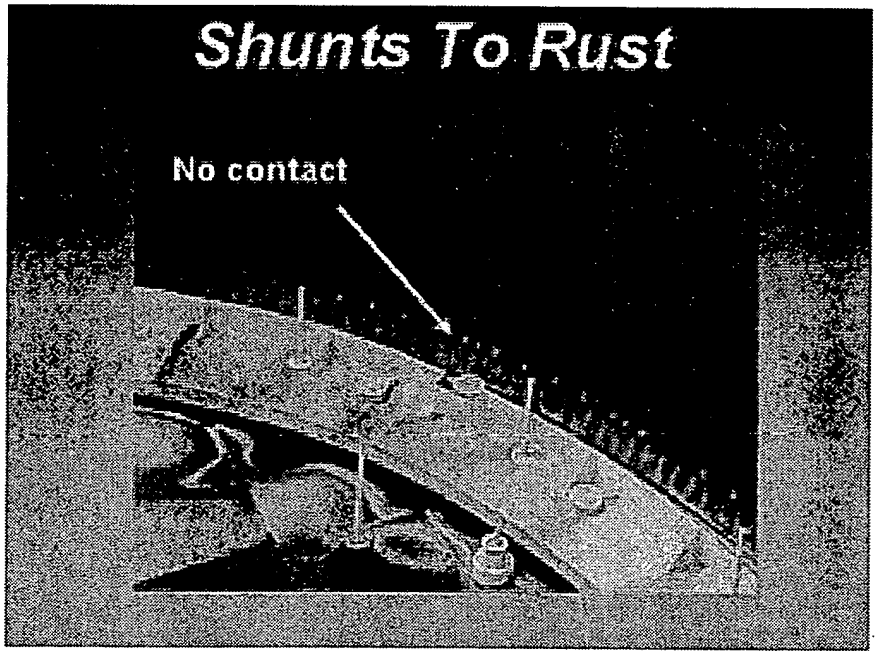

Figure 1.

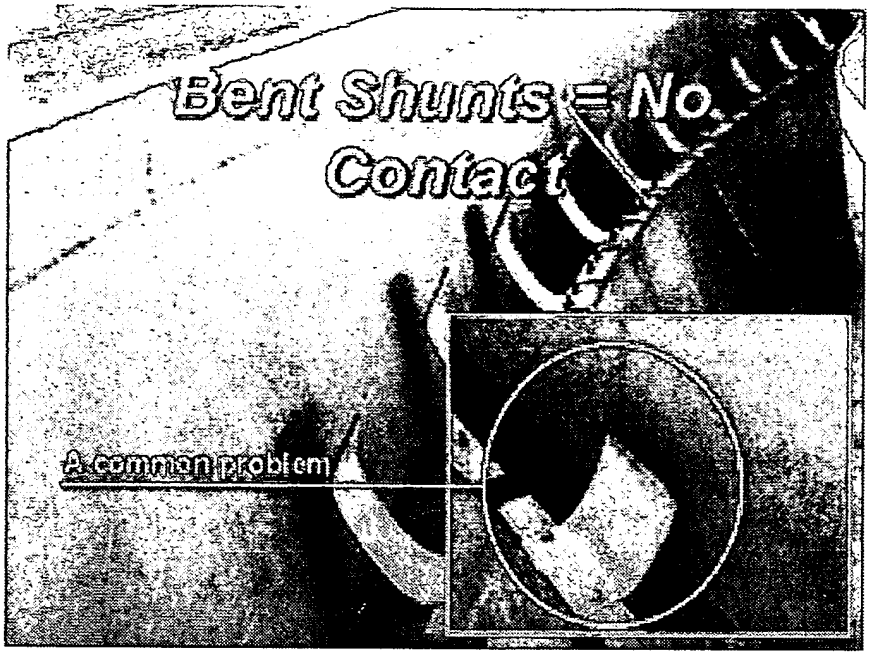

Figure 2.

Figure 3 illustrates a different form of shunt. However, measurements indicated no connection or high resistance. Again, as the result of a combination of rust, low pressure on the wall and/or heavy hydrocarbon accumulation on the tank wall.

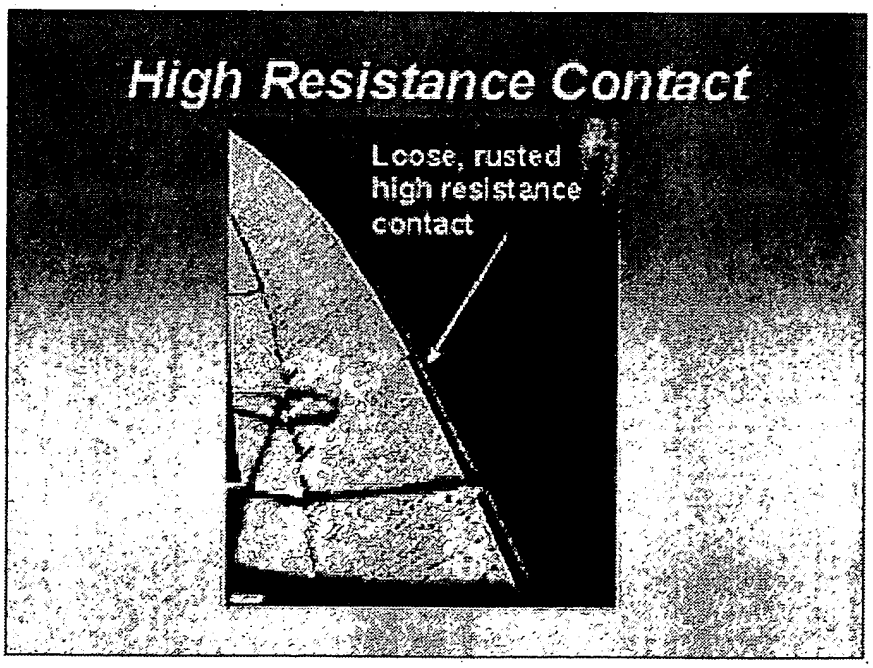

Figure 3.

Figure 4 and 5 illustrates a new trend in the industry. The tanks are being painted inside and out with a non-conductive polymer. Further, to prevent scratching that paint, they often disconnect the shunts as illustrated by Figure 5 and then paint the shunts.

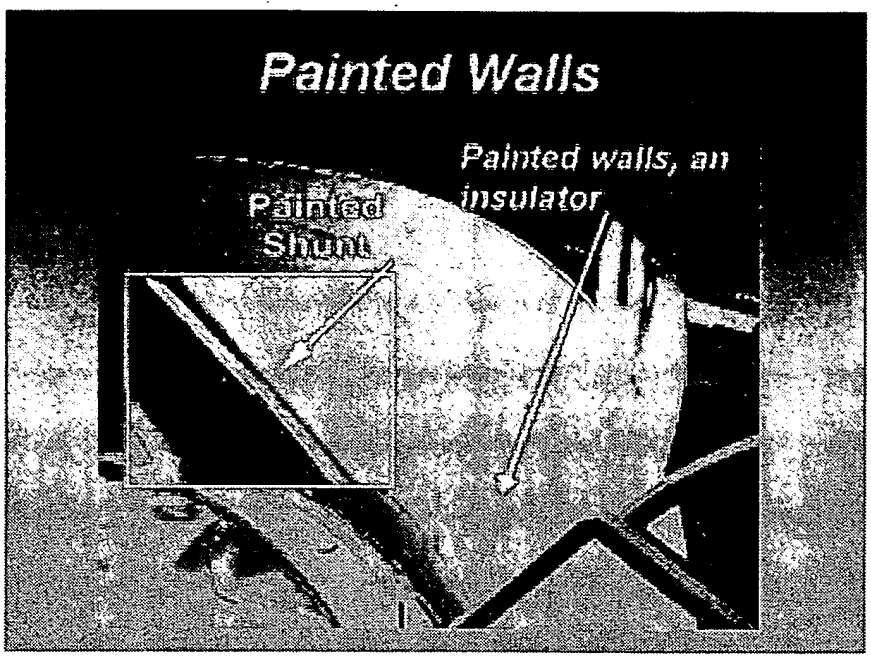

Figure 4.

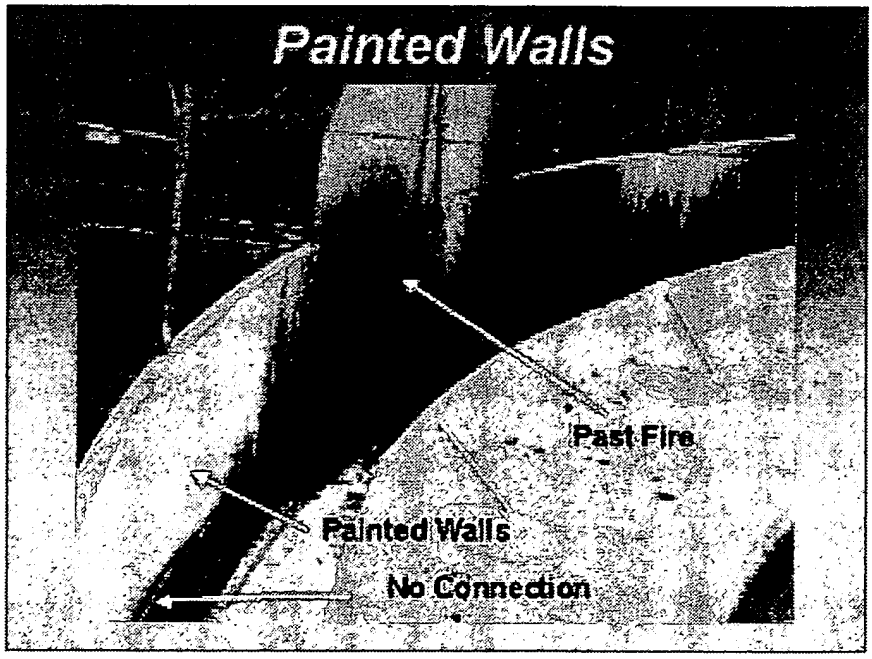

Figure 5.

Figure 5 illustrates the results where arcing initiated a rim fire. The connections "looked" satisfactory, but in fact were not, the paint insulated the roof from the wall.

Figure 6, 7 and 8 illustrate a variation of a conventional concept where the access ramp connecting the top of the tank wall to the roof was used to make the connection.

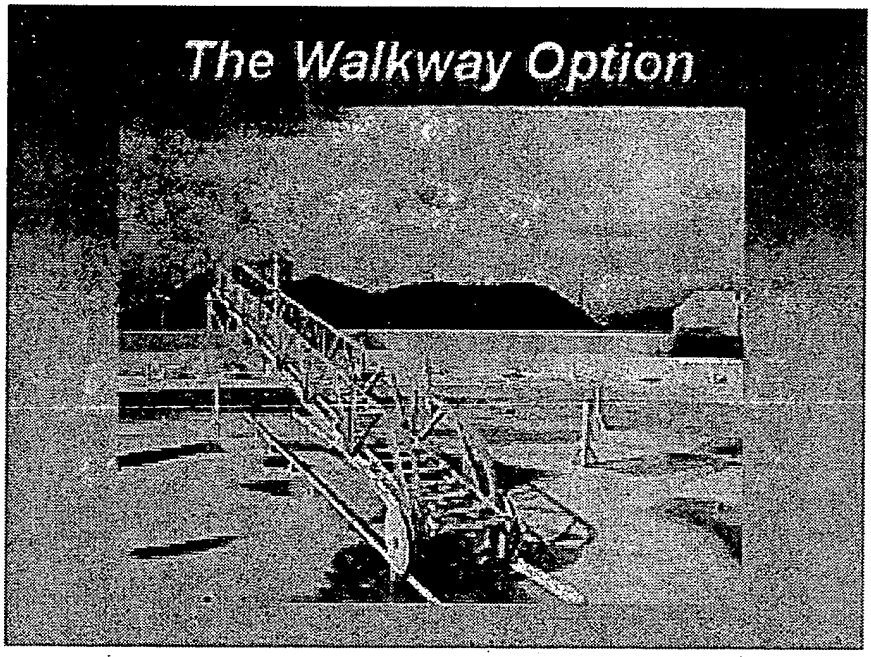

Figure 6.

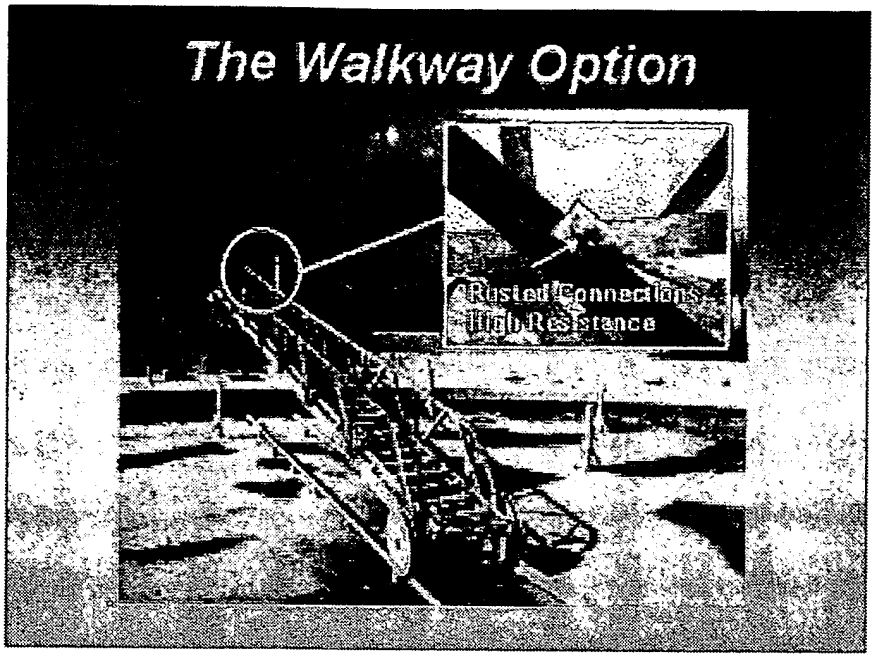

Figure 7.

Figure 7 illustrates a typical bolted connection to a painted structural member. Rust and paint insulate the joint.

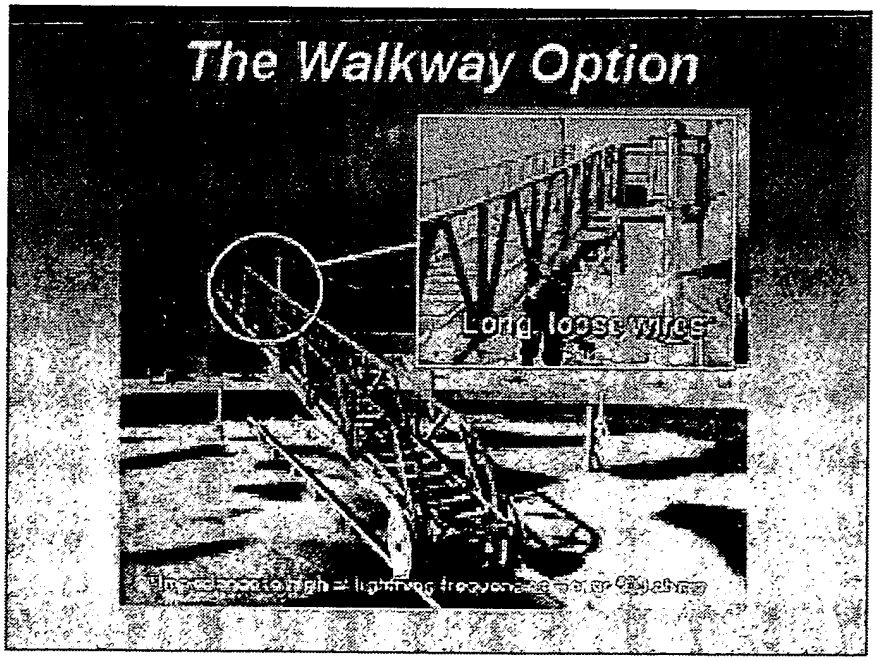

Figure 8.

Figure 8 illustrates a typical wire connection from the tank top to the ramp. It is long and loose. The reactance of this "connection" is far too high and found to be 500 ohms to lightning current flow.

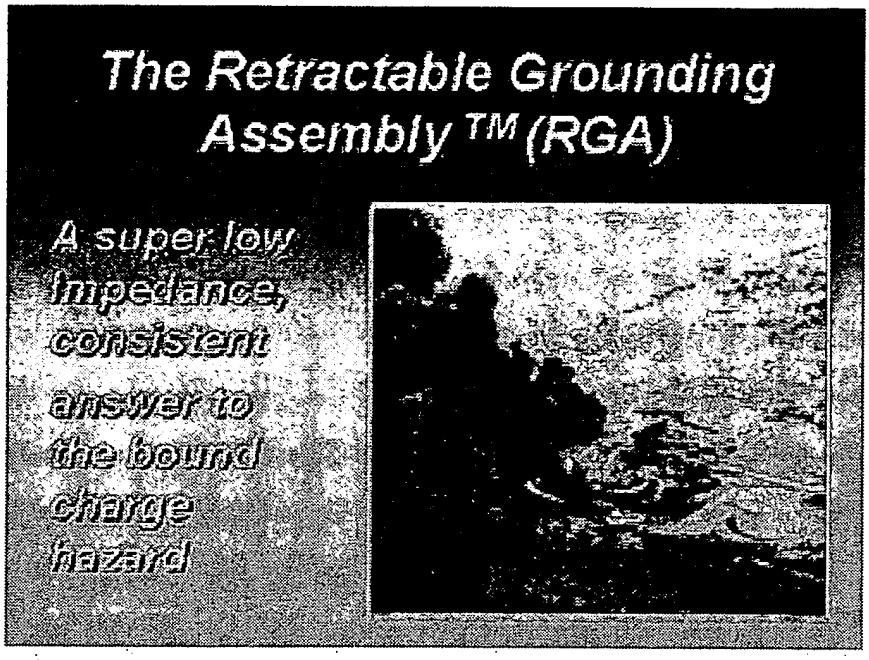

Figure 9.

Figure 9 illustrates the result of a lightning-initiated fire where bound charge was allowed to remain in the tank when lightning terminated nearby.

LEC has developed an assembly that will provide a very low impedance connection to the floating roof grounding and bonding is provided in one modest assembly. The LEC Retractable Grounding Assembly (RGA) is 100% effective and is virtually maintenance free. Further, it is independent of the condition of the tank wall and that of any shunts; and also works if no shunts are present. Figure 10.

Figure 10.

It is well known and easily proven that any large storage tank possesses the ability to make a solid, low impedance connection to earth without augmentation from any external grounding electrodes. The sheer weight of the tank, with or without the product, provides the lowest possible impedance connection to earth. The addition of one or numerous grounding electrodes will provide no measurable influence on the final measurement achieved with the tank alone.

Actually, the resistance or impedance to earth is not a problem. The problem of concern is a combination of two factors as listed below:

1. The induced charge on the tank and induced that on the contained product resulting from the influence of the storm cell electrostatic field or that created by the rapid flow of product into the tank must be removed quickly without causing a fire.

2. The poor conductivity between that product and the conductive container is such that it inhibits that discharge process.

Since petroleum products are nonconductors, they tend to hold any induced charge. That charge will, however, slowly migrate toward an attractive conductor of opposite charge. The rate of motion will be inhibited by the natural impedance of the stored product. The shorter the path to the attractive conductor (in this case, the tank wall), the quicker the discharge process. However, the charge near the center of the tank will remain much longer, creating concentration of charge in the middle of the tank. The floating roof of the tank will provide an ideal

collector/conductor, if there is a connection to the tank wall and earth. Therefore, that roof offers a critical path for the induced charge for the otherwise isolated center of that tank. Obviously, the larger the tank, the more critical this function becomes. Once the charge is collected, it is conducted to the roof edge. If there is no low impedance between the roof and the wall, there will be an arc and a subsequent fire. If the seals are tight, the fire may not proliferate. However, the risk of a fire is uncomfortably high.

Given this fact that making a good connection between the tank wall and the movable floating roof, remains the only grounding problem for these tanks. Some form of positive connection is required that will bond the two together and be independent of the roof position or any seal related anomalies.

To satisfy this requirement, LEC developed the Retractable Grounding Assembly (RGA). The RGA is a device that provides a direct connection to the tank roof from the tank wall, using a wide and thick-braided wire, wound on a reel and held in tension by spring loading. The path of impedance is held to a practical minimum by the combination of the shortest path, the wide braid and the constant tension. The wide braid is to reduce the "skin effect" at lightning frequencies, and facilitate a tight wind on the reel. The design objective was to achieve the lowest possible impedance between the roof and the wall of the tank. Figure 11.

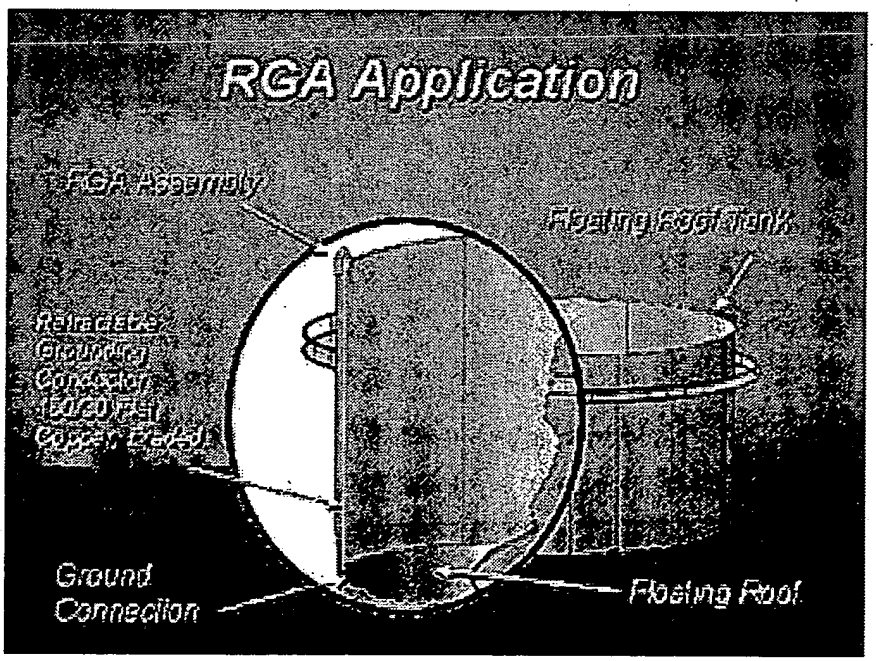

Figure 11.

The reel assembly is constructed from 316 stainless steel, with provisions for mounting on the top edge of the tank . There is one model for edge mounting, and the other for mounting on the top angle. The flat wire end is attached to a roof structure, using several possible options (again refer to the attached drawing). Since floating roof tanks tend to be of very large diameter, it can accumulate a very large body of charge in the center of the tank. That charge must be carried to the closest location of the tank wall. To assure that path is not too long, at least six or eight RGA's may be required. To limit the roof to wall impedance, the approximate number of these RGA's required is as suggested in the following table:

Tank Diameter		**Number of RGA's Recommended**
(Meters)	**Feet**	
Up to 30	90	2
Up to 50	160	4
Up to 60	200	6
Up to 70	230	7
Up to 80	262	8
Up to 90	295	9
Up to 100	320	10

Please note that these recommendations are based on the worst case impedance situation, where the tank is nearly empty and the roof is resting on or near the tank floor.

Installation Recommendations

The RGA module is designed to be bolted to the top of the tank rim. The location must be chosen such that they are in perfect alignment, vertically. To install the RGA, it is best to select the anchor point on the roof structure first, and then align the reel assembly so that it is directly above that anchor point. Refer to Figure 12. Where more than one RGA is used, they should be evenly spaced around the tank rim.

Figure 12

The following models are applicable:

RGA-1	For tanks without reinforcing angle.
RGA-2	For tanks with the top rim angle.

There are only two models of the RGA, because it is universally applicable to all Floating Roof Tanks. The only difference between the two models is the mounting assembly as previously identified.

Figure 13 illustrates a typical RGA installation as implemented at several tanks farms in Israel.

Figure 13